Review Article

The Perioperative Care of Older Patients

Time for a New, Interdisciplinary Approach

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Summary

Background: Elderly patients are a growing and vulnerable group with an elevated perioperative risk. Perioperative treatment pathways that take these patients' special risks and requirements into account are often not implemented in routine clinical practice.

Methods: This review is based on pertinent publications retrieved by a selective search in PubMed, the AWMF guideline database, and the Cochrane database for guidelines from Germany and abroad, meta-analyses, and Cochrane reviews.

Results: The care of elderly patients who need surgery calls for an interdisciplinary, interprofessional treatment concept. One component of this concept is preoperative preparation of the patient ("prehabilitation"), which is best initiated before hospital admission, e.g., correction of deficiency states, optimization of chronic drug treatment, and respiratory training. Another important component consists of pre-, intra-, and postoperative measures to prevent delirium, which can lower the frequency of this complication by 30–50%; these include orientation aids, avoidance of inappropriate drugs for elderly patients, adequate analgesia, early mobilization, short fasting times, and a perioperative nutrition plan. Preexisting cognitive impairment predisposes to postoperative delirium (odds ratios [OR] ranging from 2.5 to 4.5). Frailty is the most important predictor of the postoperative course (OR: 2.6–11). It follows that preoperative assessment of the patient's functional and cognitive status is essential.

Conclusion: The evidence-based and guideline-consistent care of elderly patients requires not only close interdisciplinary, interprofessional, and cross-sectoral collaboration, but also the restructuring and optimization of habitual procedural pathways in the hospital. Elderly patients' special needs can only be met by a treatment concept in which the entire perioperative phase is considered as a single, coherent process.

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The demographic trend in Germany means that an increasing number of elderly patients will undergo surgical procedures. More than 7 million inpatients aged 65 years or older underwent surgery in 2017 (e1). There is no standard definition for the age beyond which an individual is "old." In medicine, one often refers to individuals aged 65–75 years as the "young elderly" and 75–85 years as the "old elderly." Those aged over 85 years are occasionally referred to as "the aged" or "super-elderly."

With advancing age, risks that can have an adverse effect on the postoperative outcome in this patient group accumulate. A good postoperative outcome is defined not only by surgical success, but far more so by the preservation of performance, functionality, autonomy, and quality of life. Avoiding postoperative delirium (POD) is an important treatment goal. POD has serious sequelae for the patient's future life, including a loss of quality of life and independence, as well as increased morbidity and mortality. As a result, this frequent complication (incidence among patients ≥ 70 years: 30%–50%) has dramatic social, health-related, and socioeconomic consequences (1, e2–e4).

Methods

The evidence for the following recommendations on the perioperative care of older patients is primarily based on current guidelines, as well as on randomized controlled studies, meta-analyses, and systematic review articles (eTable). A search was carried out in PubMed, the guideline database of the Association of the Scientific Medical Societies in Germany (*Arbeitsgemeinschaft der Wissenschaftlichen Medizinischen Fachgesellschaften*, AWMF), and the Cochrane database.

Preoperative Phase

The importance of primary care physicians

Elderly patients benefit from a good preclinical work-up for their pending surgery. Optimally, this is initiated by the primary care physician and includes, e.g., compensating nutritional deficits, treatment of anemia, or optimizing long-term medication (Box). By using the national medication plan, it is possible to avoid loss of information when switching medication from the outpatient to the inpatient sector. The primary care physician's knowledge of often pre-existing multimorbidity enables the potential specific benefits of surgical treatment to be weighed up against its disadvantages in advance and together with the

BOX

Outpatient measures for the preoperative work-up of elderly patients

● Surgical work-up performed by the primary care physician

- Exclude anemia, treat where necessary
- Analyze and optimize medication, use the national medication plan
- Exclude malnutrition, prescribe oral nutritional supplements if necessary
- Determine cognitive status; document this for hospital admission
- Evaluate fall risk; document this for hospital admission
- Provide consultation regarding living will
- Provide consultation regarding prehabilitation: fall prevention, breathing exercises

patient. Moreover, the primary care physician's assessment of which drugs might need to be discontinued perioperatively or modified in terms of dose or the time at which they are taken is important.

Preoperative assessment

The aim of the preoperative work-up in elderly patients is to reliably identify common risk constellations in old age (*Table 1*) and reduce the likelihood of postoperative complications by means of preventive measures.

Risk: frailty and poor functional status

Frailty in elderly patients represents the most important predictor of the postoperative course (odds ratios [OR]: 2.6–11) (2, 3, e5–e11). Frailty is associated with the concomitant onset of a number of age-related functional impairments that make older patients more susceptible to postoperative complications (e12). A preoperative assessment should be performed to determine functional status (4, 5). In the case of high-risk patients, multimodal prehabilitation with physical training and oral nutritional supplements should be considered (6–8). Prehabilitation programs are currently being evaluated (e13). Calling in a geriatric specialist permits not only a more extensive assessment, but also enables prehabilitation measures to be carried out in a geriatric treatment unit.

Risk: chronic disorders and comorbidity

The prevalence of in particular cardiac, vascular, pulmonary, as well as metabolic and cerebral diseases is higher in old age (9, e14–e16). A guideline-compliant preoperative evaluation is able to identify these disorders, which can be further investigated by means of additional diagnostic methods (10).

Risk: pre-existing cognitive impairment

Pre-existing cognitive impairment is an important predictive factor for the development of POD (OR: 2.5; 95% confidence interval: [1.5; 4.2], OR: 4.5 [1.9; 13],

OR: 4.3 [2.2; 8.5]) (11, e17, e18). Therefore, the elderly patient's preoperative baseline cognitive status is of particular importance. Since only around 50% of dementia patients are ever medically diagnosed as such (e19), one can assume that the real number of cases is higher. Therefore, a preoperative evaluation of cognitive function is essential (5, 12, e20). DemTect (dementia detection) and Mini-Cog (short cognitive test) are suitable instruments to this end (13, e21). There is also the IQ-CODE (Informant Questionnaire on Cognitive Decline in the Elderly), which is an assessment questionnaire that can be completed by relatives or carers.

Risk: osteoporosis and fall risk

Falls are a significant health risk in old age. Approximately 35% of 65- to 90-year-olds fall once a year and 10% more than once a year (e22). Falls result in fractures and fear of falling, as well as loss of quality of life and independence. The risk of falling increases in high-risk patients following surgery, e.g., due to frailty, reduced muscle strength, and reduced mobility. A risk assessment should be carried out preoperatively. Individual or group preventive exercise programs aimed at functional improvement as part of prehabilitation can also effectively reduce fall risk (14, e23). This needs to be flanked perioperatively by guideline-compliant diagnosis and treatment of concomitant osteoporosis, particularly following a fracture (15).

Risk: malnutrition

Malnutrition is a frequent problem often overlooked in the surgical field. Its prevalence among elderly patients is between 45% and 55% (e24, e25). Malnutrition is an unfavorable prognostic factor for the perioperative course and associated with an increased rate of complications and delirium (e26). Therefore, elderly patients should be examined preoperatively for malnutrition (5). The MNA-SF (Mini Nutritional Assessment) or the NRS2000 (Nutritional Risk Screening) are suitable tools to this end (16, e27). In line with the guidelines of the German Society for Nutritional Medicine (*Deutsche Gesellschaft für Ernährungsmedizin*, DG), malnourished patients in particular should be encouraged to use oral nutritional supplements (17, 18).

Risk: polypharmacy

Polypharmacy is a relevant risk factor in elderly patients and associated with a poor postoperative outcome (e28, e29). Non-essential drugs, including non-prescription preparations, should be discontinued during the perioperative phase. A critical evaluation of potentially inappropriate medications (PIM) in the elderly, e.g., using the PRISCUS list, is most particularly recommended in the perioperative phase (5, 19, 20–22). In general, long-term cardiac medications should be continued in order to avoid rebound phenomena (e.g., tachycardia upon discontinuation of β -receptor blockers) (e30). The same applies to pain medication: preoperatively administered opioids should also be continued in the perioperative setting.

TABLE 1

Availability of German-language instruments for the preoperative assessment of elderly patients

Domain	Instrument	Availability
Frailty	e.g., Identification of Seniors at Risk e.g., LUCAS-Funktionsindex (for patients not dependent on care)	German Society for Geriatrics (<i>Deutsche Gesellschaft für Geriatrie</i>): www.dggeriatrie.de <i>Netzwerk Gesund Aktiv</i> : albertinen@netzwerk-gesundaktiv.de
Cognition	e.g., DemTect e.g., Mini-Cog e.g., IQ-CODE	Competence Center for Geriatrics: www.kcgeriatrie.de Homepage of the POSE Study: pose-trial.org/wp-content/uploads/2017/04/Mini-Cog-deutsch-für-POSE.pdf via Australian National University: http://rsph.anu.edu.au/research/tools-resources/informant-questionnaire-cognitive-decline-elderly
Malnutrition	NRS-SF (in- and outpatients) NRS2000 (inpatients)	www.mna-elderly.com oder www.dgem.de/screening
Inappropriate medication in old age	PRISCUS list	www.priscus.net

Risk: anticoagulation

Between 33%–43% of all elderly patients use long-term anticoagulants (e31). The use of anticoagulants in the elderly is essentially the same as in younger patients; however, the reduced renal function frequently seen in old age needs to be borne in mind. Important parameters for the perioperative use of novel oral anticoagulants (NOAC, non-vitamin-K-dependent oral anticoagulants) include kidney and liver function, co-medication, the time at which the drug was last used, the size and urgency of the procedure, as well as the risk of intraoperative bleeding (e.g., HAS-BLED score >3) (23, e32, e33). In the majority of cases, perioperative bridging anticoagulation is no longer recommended when using NOAC and vitamin-K-antagonists (24, e34). This recommendation does not apply to patients at high risk for thromboembolism (e.g., due to mechanical heart valve replacement, coagulation disorders, CHA₂DS₂-VAS_C score >5) (25).

Perioperative pain concept

A detailed pain history should be taken preoperatively. Presenting the patient with the pain scale to be used postoperatively (e.g., the numerical rating scale [NRS]) as early on as in the preoperative setting, as well as discussing in detail the likely postoperative analgesic concept and the use of analgesics preoperatively, is recommended.

Opioids, if unavoidable, should be administered at a reduced initial dose according to the WHO analgesic ladder. Although they have a largely non-toxic effect on organs and are effective in the elderly, they do have disadvantages in older patients, i.e., exacerbated and hazardous side effects (e.g., development of delirium, increased fall risk) and can interact with other drugs metabolized via cytochrome P450. If

possible, a non-opioid should be additionally administered in order to avoid or reduce the use of opioids. The selection of a non-opioid should be made on the basis of pre-existing disorders, with paracetamol and metamizole having the more favorable benefit–risk profile in the elderly (e35) (e35).

Intraoperative phase

The time immediately prior to surgery, the induction and maintenance of anesthesia, the surgical procedure, and the early postoperative phase are all important determinants of the postoperative course. Designing a procedure that promotes the patient's well-being and sense of orientation in the operating room represents an evidence-based, medically indicated measure for the prevention of delirium (12, 26, 27).

Preoperative fasting

Dehydration is less well-tolerated in advancing age. Excessive preoperative fasting increases discomfort and agitation and promotes the onset of POD (28). A fasting period of 6 h is adequate in terms of the prevention of aspiration (29). Clear fluids should not be avoided for longer than 2 h preoperatively, since these are not associated with an increased risk of aspiration or other complications (30). The preoperative consumption of carbohydrate-containing drinks up to 2 h prior to surgery is beneficial and, as a form of non-drug-based anxiolysis, has a positive effect on the well-being of the patient (31).

Intraoperative medication

The altered pharmacokinetics and dynamics seen in old age also affect anesthesia. Sedated older patients should always undergo neuromonitoring, since excessively deep anesthesia increases the risk for

TABLE 2

Perioperative measures in the care of elderly patients

Measure	Target group
Preoperative	
Screening for malnutrition	All patients ≥ 65 years
Evaluation of cognitive function	
Screening for frailty	
Fall-risk evaluation	
Medication analysis for potentially inappropriate medication	
Carbohydrate-containing drinks the evening before and 2 h prior to surgery	
Breathing exercises to prevent pneumonia	
Oral nutritional supplements	Malnourished or frail patients
Optimize medication perioperatively	Patients on potentially inappropriate medication
Initiate fall prevention	Patients at high risk for falls
Patient information on delirium and delirium prevention (patient participation)	High-risk patients ≥ 65 years
Keep preoperative fasting times as short as possible	
Exclude anemia and treat where necessary	
Prehabilitation (physical activity)	
Involve family in targeted manner	
Intraoperative	
Avoid benzodiazepines (except in the case of severe anxiety)	All patients ≥ 65 years
Keep hearing aids, glasses, and dentures available in the operating room	
Particularly age-appropriate surgical concept	High-risk patients ≥ 65 years
Particularly age-appropriate anesthesia: prewarming, relaxometry, age-appropriate medication	
Postoperative	
Delirium screening in the recovery room and on the ward up to postoperative day 5	All patients ≥ 65 years
Monitor oral food intake, supplement if necessary	Patients at risk for malnutrition
Delirium prevention measures on the ward: facilitate orientation, regulated sleep–wake rhythm, early mobilization, early removal of catheters and cannulas, family involvement	High-risk patients ≥ 65 years
Fluid and food management on the ward	

Although it would be desirable to implement numerous measures for all elderly patients, this will generally not be possible due to time, personnel, and financial resources. In such cases, the authors recommend their implementation at least in patients at high perioperative risk. This group includes elderly patients with frailty, cognitive impairment, or severe multimorbidity.

postoperative cognitive deficits and delirium (12). If muscle relaxants are to be used, short-acting substances should be selected where possible; metabolism that is independent of liver and kidney function is beneficial (e.g., cis-atracurium). Relaxometry should be performed concomitantly.

The duration of benzodiazepine action increases in a strongly age-dependent manner; furthermore, these substances are associated with the development of POD (32). Therefore, benzodiazepines should be used with the utmost restraint in elderly patients. In the case of active benzodiazepine abuse, which applies to no small number of elderly patients (prevalence of

around 1.2 million) (e36), abrupt discontinuation in the perioperative phase is naturally not recommended.

Opioids as well as postoperative pain increase the risk of POD (opioids: OR: 2.5 [1.2; 5.2], pain: OR: 3.7 [1.5; 8.9]) (32, e37). Therefore, adequate opioid-reduced analgesia is of great importance. Regional anesthesia techniques are recommended if the intervention and the condition of the patient permit. The patient's sensory orientation (hearing and visual aids), direct verbal communication, and non-pharmacological sedation also play an important role in the operating room in terms of delirium prevention.

Perioperative antibiotic prophylaxis

There are no significant differences between perioperative antibiotic prophylaxis (PAP) in the elderly and that in younger patients, either in terms of indication or performance. Particularly due to frequent polypharmacy, antibiotics that have a low interaction potential and which are well-tolerated are to be preferred. Beta-lactam antibiotics, in particular group 1 and 2 cephalosporins, are preferable. Elderly patients have an increased risk for multi-resistant pathogens (MRP), due to repeated hospital stays or antibiotic treatment in the preceding 3 months. In the case of confirmed MRP colonization, an adjustment of PAP should be considered depending on the individual case; however, this is generally not necessary. It may be beneficial if the resistant pathogen is found in the operating area, e.g., methicillin-resistant *Staphylococcus aureus* (MRSA) colonization of the skin. An attempt at preoperative decolonization is helpful in such cases. This applies all the more so if cardiac, neurosurgical, vascular, or orthopedic interventions are planned (e38).

Surgical procedure

Particularly in the case of elderly patients, the surgical indication should not be made solely on the basis of the question “What is surgically and technically feasible?,” but much more so on the question of “What makes sense?” (33). One should take into account here that the immediate complication and mortality rates in the early postoperative course, as well as the 1-year mortality rate following visceral surgery, are higher among patients above the age of 80 years compared to younger patients (1-year mortality: between 4.8% and 32%, depending on the type of intervention) (34, 35, e39). Therefore, the question arises as to whether a surgical approach is in actual fact associated with a better outcome for the patient compared to conservative treatment.

The adherence in trauma surgery to implementing postoperatively desired partial weight-bearing should be critically assessed preoperatively. In the case of restricted adherence, greater importance should be attributed to restoring immediate full weight-bearing than to achieving unrestricted limb mobility in the further course. The aim is to achieve definitive treatment with one single surgical procedure (e40).

Last but not least, since soft tissue management also poses a challenge, minimally invasive procedures should be considered. Ideally, individual parameters are assessed at an interdisciplinary level and across all professional groups, thereby preventing a complication-prone, one-dimensional decision-making process based on the surgical diagnosis.

Postoperative phase

Delirium screening and nursing aspects

As part of the identification of delirium, it is important to recognize early changes in the patient's awareness in order to initiate further measures. The nursing staff plays a crucial role here. Therefore, it is essential that

Pragmatic approach to the perioperative care of elderly patients

carers are aware of the risk factors for POD and are trained in the implementation of preventive measures.

There are a number of validated assessment instruments for delirium screening in intensive care units and recovery rooms that have already been tried and tested in clinical routine, e.g.:

- CAM-ICU (Confusion Assessment Method for the Intensive Care Unit)
- ICDSC (Intensive Care Screening Checklist).

There are also observation scales for wards, such as (e41–e45):

- DOS (Delirium Observation Screening Scale)
- Nu-Desc (Nursing Delirium Screening Scale)
- Four-Item Assessment Test (4AT).

Delirium screening should begin in the early postoperative phase and continue up to the fifth postoperative day (12).

Age-appropriate care in inpatient routine

Delirium prevention is of the utmost importance in the nursing care of elderly hospital patients. It has been shown that the risk of delirium can be reduced by 30%–50% as a result of preventive measures alone (1, 36, e41, e46–e48). Non-pharmacological interventions focus, for instance, on the following areas (37):

- Orientation
- Stimulation and communication
- Mobilization
- Regulating the sleep–wake rhythm
- Involving relatives and persons of trust.

Fall prevention measures, as well as monitoring and checking actual food intake by means of dietary and fluid logs, are just as important in elderly patients as adequate pain management (e37).

Postoperative resumption of normal diet

It is generally not necessary to interrupt food intake in the postoperative phase (38). An early normal oral or enteral diet reduces the risk of infection and has a

Key messages

- Elderly people represent a particularly vulnerable patient group at higher perioperative risk and, as such, require treatment concepts that are specially tailored to these risks.
- These treatment concepts should include an extensive preoperative assessment, a structured intraoperative procedure, and an equally structured postoperative inpatient treatment pathway.
- Since the primary care physician plays an important role in the preoperative work-up of the patient, collaboration between the in- and outpatient sectors needs to be further developed.
- The optimal perioperative treatment of elderly patients requires close interdisciplinary and interprofessional collaboration.
- Perioperative delirium prevention is an important therapeutic goal in the treatment of elderly patients.

positive impact on the length of hospital stay. Since elderly patients in particular often have reduced sensations of hunger and thirst, they should be encouraged to drink sufficient quantities. The daily fluid intake of all elderly patients should be known and documented in order to promptly counteract dehydration (17, 38). Patients at high nutritional risk (body mass index $<22 \text{ kg/m}^2$) in whom adequate oral food intake cannot be achieved even with nursing support should receive prompt enteral supplements, combined with parenteral supplements where necessary (17, 18, 38, 39).

Hospital discharge

More attention should be paid to the above-mentioned aspects as part of discharge management in order to plan optimal post-inpatient care for the patient together with their primary care physician. Early rehabilitation under specialist geriatric care and aimed at restoring the patient's ability for self-help, as well as functional autonomy in everyday life, should be planned in good time if required.

Summary

Good perioperative care of elderly patients can only be achieved if there is an interdisciplinary consensus on treatment planning and goal setting. In terms of the treatment goal, preserving the functional status of the patient should be given equal priority to treating the underlying disease. The cornerstones of this include the identification of individual age-specific risk factors and the prompt initiation of appropriate preventive measures. The preoperative work-up (whether in the in- or outpatient setting), surgical and anesthesia planning, the postoperative inpatient phase, as well as transfer to further outpatient care should be structured with these aspects in mind (Table 2, Figure). To this end, an interdisciplinary and cross-professional concept for the perioperative care of elderly patients needs to be developed. Improved collaboration between the in- and outpatient sectors is essential here, because only when all treating physicians and therapists know and implement this concept can the optimal benefit be conferred to the patient.

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► Supplementary material:

For eReferences please refer to:
www.aerzteblatt-international.de/ref0563

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www.aerzteblatt-international.de/19m0063

Erratum

In the article “The Effectiveness of Leech Therapy in Chronic Low Back Pain” by Christoph-Daniel Hohmann and co-authors in the *Deutsches Ärzteblatt* of 23 November 2018 (issue 47), the conflict of interest statements were lacking the following information:

Professor Michalsen in the vice chairman of the German Association for the Promotion of Medicinal Leech Therapies and the. Protection of Leeches and chairman of the board of the Karl and Veronica Carstens Foundation. Both positions are honorary appointments. **MWR**

Supplementary material to:

The Perioperative Care of Older Patients

Time for a New, Interdisciplinary Approach

by Cynthia Olotu, Arved Weimann, Christian Bahrs, Wolfgang Schwenk, Martin Scherer, and Rainer Kiefmann

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eTABLE

Assessment of evidence from relevant studies and guidelines

Perioperative significance of frailty (first author, source)		
Schmidt et al. 2018 (e10)	Prospective cohort study; 131 patients; follow-up: 1 year postoperatively	Higher 1-year mortality in patients with frailty (OR: 4.5; 95% CI: [1.2; 18.3]). Cognitive impairment associated with increased 1-year mortality (OR: 0.6; 95% CI: [0.4; 0.95]). Evidence level: moderate
Oakland et al. 2016 (e11)	Meta-analysis; 12 studies, 7960 patients	Frailty increases hospital mortality and (OR: 2.78; 95% CI: [1.6; 4.7]) 1-year mortality (OR: 1.99; 95% CI: [1.5; 2.7]). Evidence level: moderate–high
Watt et al. 2018 (3)	Meta-analysis; 44 studies, 12 281 patients	Frailty (OR: 2.2; 95% CI: [1.3; 3.6]) and cognitive impairments (OR: 2.01; 95% CI: [1.4; 2.8]) are associated with the development of postoperative complications. Evidence level: moderate–high
Delirium		
Aldecoa et al. 2017 (12)	Guideline	Preoperative identification of risk factors and implementation of POD preventive measures recommended. Evidence level: high
Siddiqi et al. 2016 (1)	Meta-analysis (Cochrane); 39 studies, 16 082 patients	Multicomponent programs are effective in POD prevention (versus standard care: RR: 0.69; 95% CI: [0.6; 0.8]). Evidence level: moderate–high
NICE Clinical Guideline 2010 (37)	Guideline	Old age, cognitive impairment, and multimorbidity are significant risk factors for the development of POD. Evidence level: high
Perioperative nutrition		
Weimann et al. 2013 (38, 39)	S3 Guidelines	Unnecessary perioperative fasting should be avoided, carbohydrate-containing drinks advisable preoperatively, perioperative nutritional therapy recommended in patients with malnutrition. Evidence level: high
Volkert et al. 2013, 2018 (17, 18)	S3 Guideline	Malnutrition and frailty increase the postoperative complication rate and mortality, perioperative nutrition concepts recommended. Evidence level: high
Polypharmacy		
Chow et al. 2012 (22, 27)	Guidelines	Non-essential medication should be discontinued perioperatively in order to avoid medication-induced complications. Evidence level: moderate–high
Holt et al. 2010 (19)	Qualitative literature analysis; expert group (Delphi)	Identification of 83 drugs as potentially inappropriate medications (PIM) for the elderly. Evidence level: moderate
AGS 2015 (20)	Systematic literature search; expert group (Delphi)	Identification of drugs as potentially inappropriate medications (PIM) in the elderly. Evidence level: moderate–high
Anticoagulation		
Douketis et al. 2015 (24)	RCT (multicenter), 1813 patients, follow-up: 37 days postoperatively	Reduction in postoperative risk of bleeding (RR: 0.4; 95% CI: [0.2; 0.8]) and no increase in thromboembolic events when “bridging” with LMWH was forgone in patients with atrial fibrillation. Evidence level: high

“Bridging,” temporary bridging anticoagulation; LMWH, low-molecular-weight heparin; RR, relative risk; OR, odds ratio; PIM, potentially inappropriate medication; POD, postoperative delirium; 95% CI, 95% confidence interval; RCT, randomized controlled trial